

K-6

Primary Science and Technology

Energy



Teachers' Guide

Energy

MODULE 1: K – 2

MODULE 2: 3– 4

MODULE 3: 5– 6

Preface

The development of learning outcomes for the core curriculum in OECS primary and lower secondary schools is an essential part of the harmonization of OECS educational systems. The curriculum harmonization process commenced seven years ago with discussions between the OECS Education Reform Unit (OERU) and educational personnel in all member countries (See *Eastern Caribbean Education Reform Project: Initiative on curriculum and remediation – Design Mission report, February 1998*).

The initiative in Primary Secondary Science and Technology commenced in 2001, with a meeting of science and technology educators in St. Vincent and the Grenadines. Time was spent initially on defining science and technology, mainly because the primary curriculum concentrated on science only. A working definition has been developed and has been used consistently throughout the development of the programme.

Draft learning outcomes were developed and circulated for comments throughout the curriculum units in the OECS. Subsequent meetings of the working group were held in St. Kitts and Nevis, St. Lucia and Antigua and Barbuda. At each of these meetings teacher educators, teachers and principals formed part of the discussion groups. After the learning outcomes were adopted by the curriculum officers, instructional modules to serve as teachers' guides were planned and developed by members of the working groups. The learning outcomes and modules were all reviewed and edited by the two consultants who worked through all phases of the project.

Time did not permit a formal piloting of the learning outcomes and modules. Since in most cases the same curriculum officer worked on the lower secondary curriculum, also, there is the possibility of the primary curriculum benefiting from the experience gained in the piloting of the lower secondary programme.

The purpose of developing the learning outcomes and instructional modules is to ensure that all children in OECS primary schools attain an acceptable level of knowledge, skills and attitudes associated with science and technology. Each member country retains the right and responsibility for integrating these outcomes into the national primary science and technology curriculum. As usual, teachers will continue to use their initiative and resourcefulness in the implementation of the programme through the use of indigenous resources creating relevance.

The OERU is extremely grateful for the contribution made by all persons and institutions that have been involved in this developmental exercise. First, OERU expresses thanks to the Canadian International Development Agency (CIDA) for the high level of interest shown and the funding provided for the Eastern Caribbean Education Reform Project (ECERP). The Ministries and Departments of Education have contributed resource personnel, accommodation, refreshment, ground transportation, and some materials for workshops. Most important, however, have been the high level of cooperation and commitment to the reform effort displayed by both the administrative and professional sections of Ministries of Education.

The following science education professionals have made significant contribution over the four-year period.

Country	Participant	Designation
Anguilla	Mr. Worrell Brooks	Education Officer, Science
	Mrs. Maria Webster	Secondary School Teacher
Antigua and Barbuda	Mr. Earl Skerritt	Science Coordinator
	Ms. Kendra Thomas	Primary School Teacher
	Ms. Celia Frederick	Secondary School Teacher
	Ms. Gracelyn Ireland	Primary School Teacher
British Virgin Islands	Ms. Beverlie Brathwaite	Education Officer, Science
Dominica	Mr. Frank Newton	Education Officer Science
	Mr. Gerald Corbette	Lecturer, Dominica State College
Grenada	Mr. Jervis Viechweg	Curriculum Officer, Science
	Ms. Janis Henry	Lecturer, T. A. Marryshow Com. College
Montserrat	Mr. Gregory Julius	Primary school Principal
St. Kitts	Mr. Hilton Clarke	Curriculum

And Nevis	Dr. Lincoln Carty	Officer, Science Former Curriculum Officer, Science Curriculum
St. Lucia	Mr. Winston Blanchard	Officer, Science Curriculum
	Ms. Imelda Polius	Former Primary School Teacher
St. Vincent and the Grenadines	Mrs. Arlene Keane-Browne	Former Curriculum Officer, Science Curriculum
	Mrs. Amaala Muhammad	Officer, Science Curriculum
	Mr. Kenroy Johnson	Principal, Secondary School

The OERU also expresses gratitude to the dozens of teachers, principals and students who have participated in discussions and consultations.

The actual planning and subsequent developmental process for the learning outcomes and Teacher's Guide became the responsibility of Dr. Cheryl Remy, former Senior Lecturer at Sir Arthur Lewis Community College, St. Lucia and Professor Winston King, Senior Lecturer, School of Education, UWI. to whom the OERU is very grateful. As a team, Dr. Remy and Professor King have encouraged workshop participants and module writers to think and to create ideas as the work progressed.

The staff at OERU together contributed in no small measure to these modules. Ms. Deborah Alphonse, Accounts/Administrative Assistant, Ms. Natasha Deterville, now Secretary to the Director of Economic Affairs in the OECS, and Ms. Cleotha Randolph, Documentation Officer, worked tirelessly arranging workshops and reproducing materials. Ms. Natalie Compton of Nagio Creations competently designed the layout of the modules and learning outcomes for printing and electronic reproduction.

Dr. Henry Hinds, formerly Curriculum Specialist at OERU was responsible for the curriculum project. Mrs. Lorna Callender and Ms. Candia Alleyne, both former Heads of OERU, have supported the project organizationally and morally. Mr. Johnson Cenac, ECERP Officer, made significant contributions in various ways and at various times throughout the development of this work.

The Primary Science and Technology modules provide an excellent example of the fusion of talent, creativity, rigorous science and technology and cooperation to develop a valuable resource for teachers.

The OERU hopes that principals and teachers will continue to play their roles in making the outcomes and modules come to life in classrooms throughout the OECS. The commitment and effort surely will contribute to the enhancement of knowledge, and skills and the development of positive attitude towards science and technology.

Henry Hinds, Head, OERU

August, 2006

Energy

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RATIONALE

Children, from a very early age, interact with the various forms of energy in the home. For example, light bulbs are turned on to produce light from electricity. Electricity is used to play stereo equipment, and produces sound, another form of energy. The importance of electricity and numerous devices that utilize electrical and other forms of energy cannot be over-emphasized. Such devices are seen everywhere and we are left to wonder when the world would be without them. There is the need to awaken the awareness in students of the relationship among devices that use or convert or produce heat, light, electricity and sound. This awareness, it is hoped, could also foster positive attitudes to Science.

Children, at a very early age, are very curious and they also take a very investigative approach to finding out things – Science. They also enjoy making things - Technology. The designing and making of devices to demonstrate movement, ties in with the Technology aspect of the module. Technology should be seen always as integrated with Science and should be taught in an integrated way.

INTRODUCTION

This module looks at Energy. The word, 'energy', in our everyday speech, has a variety of meanings. We say, for example, 'move as if you have energy'. Energy is a word that we use all the time but it means different things to different people.

It is hoped that the activities that are suggested for students will be of use to teachers. Teachers must feel free to apply the ideas appropriately to the learning environment.

THE EXPERIENCES IN THESE MODULES WILL HELP THE STUDENTS TO DEVELOP THE FOLLOWING MAJOR IDEAS

ENERGY

- *Changes involving both living and non-living things require energy.*
- *Energy has many forms such as heat, electricity, and light.*
- *Energy can be converted from one form to another and this occurs when changes take place.*
- *Energy can be derived from many sources including the sun.*
- *Energy is in great demand and non-renewable energy resources must be wisely used.*

TECHNOLOGY

- Technological methods involve the use of problem solving, technological processes and resources to find solutions to people's wants and needs.
- Technology is a human activity.
- Individuals can take part in Technological activity.
- Technology involves the uses of materials, energy, tools/machines and information.
- Technology processes include Biotechnology, Production Technology and Transportation .
- Technology changes over time.
- Technology is neither good nor bad, but the way we use it can have positive or negative effects on our lives.
- The use of technology has side effects.

SCIENCE TECHNOLOGY, SOCIETY AND THE ENVIRONMENT

- Science and Technology affect human life, the society and the environment.
- The impact of Science and Technology can be positive or negative, unplanned or planned, immediate or delayed.
- There should be sustainable use of resources and efforts should be made to minimize ecological disturbances.
- People's values, beliefs and attitudes influence Scientific and Technological activity and use.

Module 1

Energy

Grades k - 2

GENERAL OBJECTIVES

The students should be able to:

1. Develop an awareness of heat, light, sound, and electricity in the context of changes taking place.
2. Develop an awareness of devices that use/ convert/ produce heat, light, electricity and sound.
3. Design and make devices powered by moving air and water.
3. Develop awareness of the importance of heat, light, sound, and electricity in our daily lives.

SPECIFIC OBJECTIVES

The students should be able to:

1. Identify a variety of moving objects.
2. State a variety of ways in which objects move.
3. Identify the conditions (inputs) needed for objects to move in a given situation.
4. Design and make paper aeroplanes, boats, windmills, and water wheels.
5. Identify food as a source of energy for themselves and other living organisms.
6. State some uses of heat, light, sound, and electricity in our daily lives.
7. Operate a simple device or system and identify the input and output (e.g. flashlight, lamp, toy).
8. List some uses of the sun in everyday activities.
9. Identify devices that use moving air and moving water as energy sources (e.g. windmills, water wheels).
10. Design and construct a device propelled by air (e.g. kite, balloon, rocket).
11. Demonstrate how sounds can be made.
12. Design and construct guitars, drums, bottle organ.
13. Investigate the effect of manipulating variables on sounds produced.
14. Identify devices in the home that use electricity.

15. Identify ways in which technology related to energy use has enhanced the lives of people in the past and now.
16. Imagine how their lives would change without heat and electricity.
17. State safety measures in using electrical devices.
18. Compare old and new technological devices.

**LEVELS OF ATTITUDES, SKILLS & TECHNOLOGY EXPECTED AT
GRADES K - 2**

ATTITUDES:

Students should be encouraged to:

Curiosity:	<ul style="list-style-type: none">✓ Ask questions about objects and events.✓ Find out more about events and objects on their own.
Inventiveness:	<ul style="list-style-type: none">✓ Suggest new ways of doing things.
Respect For Evidence	<ul style="list-style-type: none">✓ Explain their results and conclusions.✓ Listen to other students' results and explanations.
Persistence	<ul style="list-style-type: none">✓ Complete activities.✓ Persist at tasks.
Respect For Living Things	<ul style="list-style-type: none">✓ Show sensitivity to living things.
Cooperation	<ul style="list-style-type: none">✓ Share with others.✓ Work together with others.
Concern For Safety	<ul style="list-style-type: none">✓ Observe safety instructions.

SKILLS:

In developing their skills of inquiry, problem solving and design, the students are expected to:

Observing	<ul style="list-style-type: none"> ✓ Use as many senses as are appropriate and safe to gather information. ✓ Identify differences and similarities between objects and events. ✓ Identify sequence in events.
Measuring	<ul style="list-style-type: none"> ✓ Use simple measuring instruments or models of measuring instruments. At first use comparative terms such as bigger, smaller and later use actual figures.
Manipulating	<ul style="list-style-type: none"> ✓ Set up simple experiments to compare results. ✓ Manipulate simple equipment.
Recording	<ul style="list-style-type: none"> ✓ Use pictures and charts to report results. ✓ Fill out simple tables to report results.
Classifying	<ul style="list-style-type: none"> ✓ Group objects according to one or two criteria.
Communicating	<ul style="list-style-type: none"> ✓ Talk freely about their activities and the ideas they have, with or without making a written record. ✓ Use appropriate vocabulary to describe their observations. ✓ Listen to others' ideas and look at their results. ✓ Report events by using demonstrations, role play, simple drawings, paintings and simple sentences.
Inferring	<ul style="list-style-type: none"> ✓ Notice patterns in simple measurements and events.
Interpreting data	<ul style="list-style-type: none"> ✓ Discuss what they find out in response to questions.
Experimenting	<ul style="list-style-type: none"> ✓ Freely ask a variety of questions and suggest how they might be answered. ✓ Suggest how they could investigate to find out answers to questions.
Predicting	<ul style="list-style-type: none"> ✓ Attempt to make predictions (even if not based on patterns).
Problem Solving	<ul style="list-style-type: none"> ✓ Suggest solutions to simple problems.
Designing	<ul style="list-style-type: none"> ✓ Construct models either by following instructions or by using their own designs. ✓ Select appropriate material to make models and gadgets.

TECHNOLOGY

Technological Methods	<ul style="list-style-type: none">✓ Given problems, the students will be able to discuss and make simple gadgets.
Nature Of Technology	<ul style="list-style-type: none">✓ Realize that people use natural things. and also make other things from them.✓ Realize that they can design and make things which may be different from what others make.✓ Share information with others.✓ Realize that safety is important in using tools and making things.
<u>Use Of Technology</u>	<ul style="list-style-type: none">✓ Appreciate the use of devices, tools and structures made by humans in the home and community.✓ Appreciate the advantages of using these products.✓ Realize that human-made things can pollute the environment.

UNIT: ENERGY (GRADE K)

DURATION: 2 Lessons

OBJECTIVES:

Students should be able to:

1. Identify a variety of moving objects in the environment.
2. Indicate the direction in which various objects move.
3. Demonstrate and identify body movements.

PROCESS SKILLS

Observing, Classifying, Communicating

MATERIALS

Living organisms in the environment, toys, vehicles, household appliances, students' bodies

CONTENT SUMMARY

- There are many objects in the home, school and surroundings that move (appliances, tops, vehicles, animals)
- Objects move in different directions (up/down (e.g. a yo-yo), forward/backward (e.g. a toy car), circular/rotational e.g. a top or the blades of a fan), back and forth (e.g. a swing)
- Several parts of our bodies can move (hands, fingers, legs, lips, jaws, eyes, head etc).

SUGGESTED ACTIVITIES

- Take group on a walk around the school grounds to **observe** moving objects and living things.
- Use these observations to stimulate class discussion. Let the students name the objects that they saw moving. Let them say the direction of movement (up, down etc.).
- Let students identify things and objects that cannot move on their own.
- Students groups things as those that move and those that do not (Classification).
- Play game in which each student gets an opportunity to move any part of his/her body. The rest of the class follows after the moving body part has been identified.

- Let students play with toys (tops, wind-up cars, etc and state the type of motion (circular/rotational, backward/forward, etc).
- Teacher demonstrates movement using an electric fan, a blender, etc. Students should state the type of movement observed.

ASSESSMENT

- Let students identify objects that move (from their earlier observations) and name any other objects they know can move.

DURATION: 2 sessions

OBJECTIVES

Students should be able to:

1. Design and make paper aeroplanes and boats.

PROCESS SKILLS

Manipulating, Evaluating

SUGGESTED ACTIVITIES

- Distribute a sheet of 8" X 11" paper to each student and let students use it to make an aeroplane. They can add colour to their aeroplanes.
- Take students outside to fly their planes.
- Distribute a similar sheet to each student and let the students make boats.
- Take students outside and let them place boats in large container with water.

ASSESSMENT

- Give students encouraging feedback about their efforts. Allow them to show their aeroplanes and boats to the class and talk about them.

DURATION: 1 Lesson

OBJECTIVES

Students should be able to:

1. Demonstrate how sounds can be made.
2. Identify objects or events in the environment by the sounds they make.
3. Identify sounds in the immediate environment.
4. Describe sounds by using appropriate words.

PROCESS SKILLS

Observing, Communicating, Manipulating

MATERIALS

Musical instrument (drums, recorders, guitars, horns) other objects (sticks, cans, combs, flamboyant pods, balloons).

CONTENT SUMMARY

- Sounds can be produced in different ways;
 - Striking – drums, palms of the hand, steel pans
 - Plucking – strings, guitars
 - Blowing – flute, mouth organ, whistle
 - Squeezing – horns
 - Shaking – pods, shak-shaks
- Many objects in the environment produce sound, For example: -
 - horns of vehicles
 - engines of vehicles
 - Animals (birds, frogs, dogs. etc.)
- Sounds have special characteristics. They may be:
 - High or low
 - Loud or soft

SUGGESTED ACTIVITIES

- Distribute the materials around the class or let students go to a collection point to choose them.
Ask students (in turn) to use what they have to make selected sounds.

- Ask students to close their eyes and listen to sounds around the school.
Let them try to imitate the sound and identify the object making the sound.
- Teacher demonstrates soft/loud and high/low sounds using voices, beating drums, plucking strings etc. Let students use words such as soft/loud, high/low, etc. to describe the sounds. Then students are asked to make a particular sound (soft/loud, high/low).

ASSESSMENT

- The teacher goes out of students' view, uses an object or body part to make a sound, then emerges and asks students to identify the source.
- Present students with sound-making objects/instruments and /or pictures of these things and let students group them according to the way the instruments/objects produce sound.
- Let students design and make an instrument.

UNIT: ENERGY (GRADE 1)

TOPIC: ELECTRICAL DEVICES IN THE HOME

DURATION: 1 Lesson.

OBJECTIVES:

Students should be able to:

1. Identify devices in the home that use electricity.
2. Infer that electricity is a form of energy.

PROCESS SKILLS

Communicating, Classifying

MATERIALS

Pictures of electrical appliances (stove, iron, radio, fan, television, VCR).
Some common electrical appliances – blender, curling pressing iron, iron, fan, radio, etc.

CONTENT SUMMARY

- Electricity is widely used in the home.
- We can use electricity to get things to move, to provide heat up, to make sounds, to give light, etc.)
- Batteries provide electricity.

SUGGESTED ACTIVITIES

- Let students name devices at home, at school or in the community that use electricity.
- Use pictures and/or appliances to stimulate class discussion (e.g. fan, blender, iron etc). Display one at a time and question students about the changes that take place when the electricity is turned on; e.g. the iron gets hot, the radio makes a sound, the fan spins, etc.
- Turn on an appliance that is not connected to the mains supply and let students explain what happens and why, and what must be done to make the appliance work. Explain that electricity provides energy that these devices need to work.

- Use a toy that works on batteries. Put in the batteries. Turn on the switch and let students talk about what happens. Remove the batteries. Turn on the switch and let students observe and talk about what happens.

ASSESSMENT

- Checklist with pictures of devices that use electricity and some which do not.
Let students tick those that use electricity.
- Let students pretend to be electrical appliances. Let them demonstrate how they will change/what they will do when the electricity is turned on.

TOPIC: SAFETY

DURATION: 1 Lesson

OBJECTIVE:

Students should be able to:

1. State safety measures in using electrical devices.

PROCESS SKILLS

Communicating, Inferring.

MATERIALS

Sockets, plugs, electrical appliances

Pictures showing unsafe practices, dangerous situations e.g. fallen electricity lines.

CONTENT SUMMARY

- Electricity brings many benefits into our homes but it can bring danger too.
- Apart from fires, electricity can cause serious injury and even death. It is best to be very careful when using electricity at home.

SUGGESTED ACTIVITIES

- Discuss some possible dangers of electricity – shocks, burns, and fires
- Let students relate accounts of incidents they might have heard of involving the dangers of electricity.
- Teacher discusses safety rules with students displaying the pictures.

Rules:

- Do not plug anything into light socket except light bulb.
- Do not push anything into sockets except electrical equipment.
- Do not push anything into outlets except plugs.
- Do not touch bare/ exposed electrical wires.
- Do not touch electrical appliances and fittings with wet hands.
- Seek guidance from an adult when there is a need to use electricity.

ASSESSMENT

- Describe situations based on the rules. Let students bow their heads if it is not safe and raise their heads if it is safe. (Game)

TOPIC: USES OF ENERGY

DURATION: 2 Lessons

OBJECTIVES:

Students should be able to:

1. State the use of heat, light, and electricity in our daily lives
2. List some uses of the sun in everyday activities.

PROCESS SKILLS

Observing, Communicating, Manipulating, Predicting

MATERIALS

Sunlight, flashlight, pictures of appliances that use light, electricity or heat, to function, appliances and devices, ice, candle, plants.

CONTENT SUMMARY:

- In our daily lives we use
 - heat to keep us/things warm, for cooking, for drying things
 - light to help us to see, to make some calculators work
 - sounds to make music, appreciation, listening, communicating
 - electricity to produce light, heat, to make things move, for cooking, for providing energy for appliances and devices to function/work
- The sun provides us with energy in the form of light and heat.
- Plants use the light of the sun to grow.
- We use the heat of the sun to dry things, e.g. clothes, seeds and foods.
- We must use heat, light and electricity safely since they can cause harm.

SUGGESTED ACTIVITIES

- Teacher guides students to place similar pieces of candle wax and ice in the sun and in the shade. Let students observe and compare what happens.
- Teacher presents students with two similar plants, one of which was placed in the dark for about a week (but watered regularly) and one which was kept under normal conditions. Let students observe and compare the two plants and infer what was responsible for the difference in appearance.
- Teacher makes various devices, appliances, toys work using
 - electricity from the mains and batteries
- Teacher lets students role play to demonstrate safety when using
 - heat, light and electricity

ASSESSMENT

- Interviews – basic questions, e.g.
 - If the sun did not shine at all, what do you think will happen, and why?
Let students explain.
- Let students complete a picture table as shown below. They use a tick to indicate the form of energy being used.

Activity	Electricity	Heat	Light
Picture 1		v	
Picture 2			
Picture 3, etc			

TOPIC: ENERGY SOURCES

DURATION: 3 Lessons

OBJECTIVES

Students should be able to:

1. Identify the source of energy which enables objects to move in given situations.
2. Make toys that can move.

PROCESS SKILLS

Observing, Classifying, Predicting, Communicating, Designing

MATERIALS

Battery operated toy cars and trucks, wind-up toy cars and trucks, clocks, toy cars and trucks which must be pushed or pulled, rubber bands, pencils, cotton reels.

CONTENT SUMMARY

- In order to move objects must have a source of energy
- This energy can be obtained from batteries, wound-up springs/rubber bands, humans.

SUGGESTED ACTIVITIES

- Demonstrate the operations of battery-operated toys. Let students predict what will happen if there is no battery.
- Repeat activity using wind-up toys.
- Display the third set of toys and let students suggest what makes them work.
- Let students use rubber bands to wind up pairs of pencils and then release them. Observe what happens to the rubber bands and the pencils. Let students discuss the results.
- Let students design and make toy trucks using easily available materials from the environment (plastic bottles, bottle stoppers, etc).

Let them devise ways of getting them to move. Let them race their vehicles.

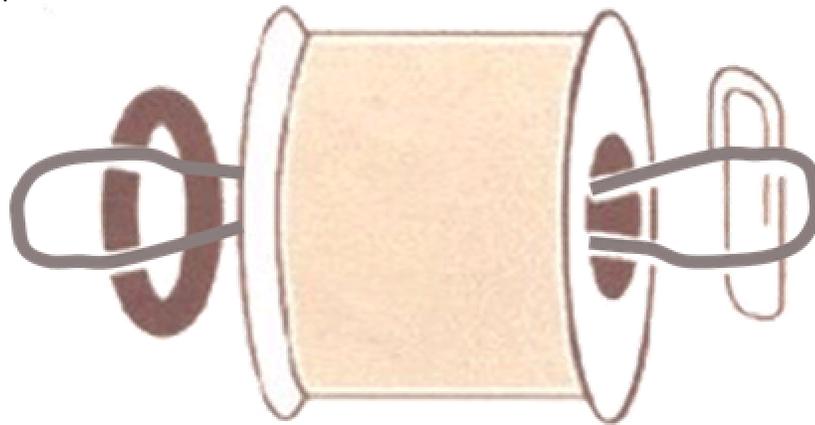
- Let students design and make a cotton-reel tractor as follows:

MAKING A RUBBER BAND MOTOR

MATERIALS:

Thread, cotton reel, rubber band, cotton swab, metal washer, paper clip

PROCEDURE:



- Pull a rubber band through the hole of a used spool of thread.
- Put a paper clip through one end of the rubber band.
- Tape down the clip to the side of the spool.
- Pull the other end of the rubber band through a washer and put a matchstick through the loop.
- Wind up the matchstick.
- When it feels tight, place the cotton reel on a flat surface.
- Let it go and see what happens.

After students have made their vehicles and observed them for some time, teacher asks them questions such as:

- What happened when you turned the matchstick?
- What happened to the rubber band when you released the vehicle?
- What made the vehicle move?
- What other things are made to move like this?

Teacher then asks students if they can change their vehicles in any way (use a bigger rubber band, use a longer matchstick, cut grooves in the cotton reels, do something to keep the twisted rubber band tighter, etc.) Let students change one thing (variable) on their vehicle and predict how

it will affect its movement. Students try out their suggestions and note the difference with the way the vehicle moved before.

ASSESSMENT

1. Group toys based on their mode of movement.
2. Assess the efforts students made in making their cotton-reel vehicles. Include assessment of attitudes, such as persistence and cooperation.

UNIT: ENERGY (GRADE 2)

TOPIC: MAKING USE OF TECHNOLOGY

DURATION: 2 Lessons

OBJECTIVES:

Students should be able to:

1. List devices in the home and community that use electricity or other forms of energy.
2. State ways in which energy-using equipment has improved the quality of our lives.
3. Suggest difficulties we may encounter without the use of such equipment.
4. Appreciate that people use energy to solve some of their problems.
5. Compare old and new technological devices.
6. Infer that people keep inventing new things to make them better.

PROCESS SKILLS

Observing, Communicating, Inferring, Classifying.

MATERIALS

- (1) Pictures of home and community settings showing various items of equipment and appliances: refrigerators, stoves, cookers, toasters, vehicles, etc.
- (2) Small home appliances – toasters, blenders, electrical irons.
- (3) Pictures depicting older forms of technology – wood fires, donkey-carts.

CONTENT SUMMARY

- Electricity is a form of energy.
- Many devices in our homes and community need electricity to work.
- Some equipment in the home and community use other forms of energy (kerosene stoves, gas cookers, vehicles use gasolene and diesel).

- Energy-using equipment in the home and community has helped to improve the quality of our lives.
- Refrigerators preserve our food so we can buy in bulk.
- Gas, electrical and kerosene stoves are more convenient to use than wood fires.
- Vehicles take us to our destinations faster than if we had to walk or use donkey carts.

SUGGESTED ACTIVITIES

1. Use picture display to stimulate class discussion on equipment in the home and community that use electricity. First, let students identify the devices, then have them suggest ways in which they are useful.
2. Use picture display to stimulate a similar discussion on equipment that use other forms of energy.
3. Demonstrate the use of similar small appliances: blender to grate coconut, toasting bread in a toaster.
4. Use pictures of older technology to stimulate discussion on the difficulties we may encounter without the use of modern technologies.
5. Allow children to compare old and new technologies (e.g. rotary and touch phones; digital and analogue clocks; sail and motor boats). Let students record their findings in a Table.
6. Let students discuss with their grandparents how they did certain tasks when they were young and write a short paragraph about their findings and collect pictures if possible.

ASSESSMENT

Game of musical chairs in which the players wear picture labels depicting different equipment. As players get out let group list the problems they would face without that player/equipment.

Assess students' ability to observe, infer and communicate in Activity 5.

TOPIC: WINDMILLS AND WATERWHEELS

DURATION : 1 Lesson

OBJECTIVES

Students should be able to:

1. Observe and identify devices that use moving air and moving water as energy sources (e.g. windmills, water wheels).
2. Infer that wind and water are sources of energy.

PROCESS SKILLS

Observe the movement of water wheels and windmills.
Communicate what causes the movement.

MATERIALS

Pictures of windmills, water wheels, video tape of windmills, water wheels, pieces of cardboard, open umbrella devices.

CONTENT SUMMARY

- Devices such as windmills and water wheels need moving air/water to make them move.
- The wind provides the energy to move the windmills and the moving water provides the energy to move the water wheels. Water wheels and windmills are used to turn machines in factories and generate electricity.

SUGGESTED ACTIVITIES

- Let students try to run with an umbrella, first opened and then closed. Discuss observations and establish that air/the wind can produce a force and that this force can be used to make things move.
- Display pictures of windmills and waterwheels in use. Show videotape if available. Use these to stimulate discussion on the devices
 - Identify what they are
 - Establish how they work
 - Establish what they are used for (turning machine in a factory, generating electricity, etc)

Let students find out where there are windmills and water in use in their community or country.

ASSESSMENT

Checklist- Did students identify correctly/communicate clearly?

Module 2
Energy
Grades 3 - 4

GENERAL OBJECTIVES

The students should be able to:

1. Appreciate the importance of heat and light in our everyday lives.
2. Realize that heat and light affect matter.
3. Identify fuels and the Sun as sources of heat and light.
4. Understand that energy can be transferred from place to place in different forms.

SPECIFIC OBJECTIVES

The students should be able to:

1. Identify natural and human-made objects that emit heat and light (sun, candle, fire, lamps).
2. Appreciate the role of the Sun as the main provider of heat and light on the Earth.
3. Appreciate the role of human-made devices that provide heat and light in our daily lives.
4. State ways in which heat and light are used in everyday activities.
5. List examples of fuels used in their country in the home, for transportation, and production.
6. Discuss some unintended consequences of using fuels for transport, and in production processes (e.g. pollution, depletion of resources. etc.)
7. State ways in which solar energy is used in the home.
8. Investigate the effects of heat on matter (e.g. change in temperature).
9. Use a thermometer to measure temperature.
10. Investigate the effects of light on materials.
11. Trace the flow of energy in a system (e.g. sun ---plants producing food).
12. Give simple examples of energy transformation.
13. Draw a time line to show how technology for a particular purpose for example, transport, heating, lighting, has changed over a period of time.
14. Compare devices used to provide heat or light on selected criteria .

**LEVELS OF ATTITUDES, SKILLS & TECHNOLOGY EXPECTED AT
GRADES 3 - 4**

ATTITUDES:

Students should be encouraged to:

Curiosity:	<ul style="list-style-type: none"> ✓ Ask questions about objects and events. ✓ Find out more about events and objects on their own.
Inventiveness:	<ul style="list-style-type: none"> ✓ Suggest new ways of doing things. ✓ Use equipment in novel ways.
Respect For Evidence	<ul style="list-style-type: none"> ✓ Explain their results and conclusions using some evidence. ✓ Listen to other students' results and explanations. ✓ Begin to recognize when conclusions do not fit the evidence.
Persistence	<ul style="list-style-type: none"> ✓ Complete activities. ✓ Persist at tasks.
Respect For Living Things	<ul style="list-style-type: none"> ✓ Show sensitivity to living things.
Cooperation	<ul style="list-style-type: none"> ✓ Share with others. ✓ Work together with others. ✓ Accept responsibilities.
Concern For Safety	<ul style="list-style-type: none"> ✓ Observe safety instructions.

SKILLS

SKILLS:	In developing their skills of inquiry, problem solving and design, the students are expected to:
Observing	<ul style="list-style-type: none"> ✓ Use as many senses as are appropriate and safe to gather information. ✓ Identify differences and similarities between objects and events. ✓ Identify sequence in events.
Measuring	<ul style="list-style-type: none"> ✓ Use simple measuring instruments or models of measuring instruments. At first use comparative terms such as bigger, smaller and later use actual figures.
Manipulating	<ul style="list-style-type: none"> ✓ Set up simple experiments to compare results. ✓ Manipulate simple equipment.
Recording	<ul style="list-style-type: none"> ✓ Use pictures and charts to report results. ✓ Fill out simple tables to report results.
Classifying	<ul style="list-style-type: none"> ✓ Group objects according to several criteria.
Communicating	<ul style="list-style-type: none"> ✓ Talk freely about their activities and the ideas they have, with or without making a written record. ✓ Use appropriate vocabulary to describe their observations. ✓ Listen to others' ideas and look at their results. ✓ Report events by using demonstrations, role play, simple drawings, paintings and paragraphs. ✓ Use bar graphs, pictures, tables and charts to report results. ✓ Use books and other sources to find information.

SKILLS CONT'D

Inferring	<ul style="list-style-type: none"> ✓ Notice patterns and relationships in simple measurements and events.
Interpreting data	<ul style="list-style-type: none"> ✓ Discuss what they find out in response to questions. ✓ Compare their findings with their predictions. ✓ Notice changes when one variable is changed.
Experimenting	<ul style="list-style-type: none"> ✓ Freely ask a variety of questions and suggest how they might be answered. ✓ Suggest how they could investigate to find out answers to questions. ✓ Have some idea of the variable that has to be changed or what different things are to be compared in an investigation. ✓ Suggest equipment, materials and procedure for conducting investigations.
Predicting	<ul style="list-style-type: none"> ✓ Attempt to use evidence in making predictions.
Hypothesizing	<ul style="list-style-type: none"> ✓ Attempt to explain things that are consistent with evidence. ✓ Suggest how something may have happened.
Problem Solving	<ul style="list-style-type: none"> ✓ Suggest solutions to simple problems.
Designing	<ul style="list-style-type: none"> ✓ Construct models either by following instructions or by using their own designs. ✓ Select appropriate material to make models and gadgets. ✓ Formulate problems, do appropriate research, and devise solutions. ✓ Select appropriate material to make models and gadgets. ✓ Evaluate their own designs using simple criteria.

TECHNOLOGY

<p>Technological Methods</p>	<ul style="list-style-type: none"> ✓ Students will be able to formulate problems, do appropriate research and devise solutions (e.g. construct gadgets).
<p>Nature Of Technology</p>	<ul style="list-style-type: none"> ✓ Look at past inventions in their historical context. ✓ Understand that products are replicable. ✓ Understand that others may be working on the same idea. ✓ Realize that <i>they can use scientific knowledge in doing technology</i> and that technology helps to develop reliable scientific information. ✓ Understand the importance of precision and safety in developing new products. ✓ Understand that technology is novel and creative. ✓ Understand that if the people in a country are creative and innovative, their country can progress. ✓ Understand that people use processes involving living things (Biotechnology) and materials (Production Technology) to satisfy their needs.
<p>Use Of Technology</p>	<ul style="list-style-type: none"> ✓ Appreciate the use of devices, tools and structures made by humans in the home and community. ✓ Appreciate the advantages of using these products. ✓ Realize that human-made things can pollute the environment. ✓ Look at advantages and disadvantages to help them make decisions of what is the best technology that can be used in a particular situation. ✓ Realize that people may abuse and misuse technology. ✓ Understand that technology may have unintended consequences.

UNIT: ENERGY (GRADE: 3)

DURATION: 3 Lessons

OBJECTIVES

Students should be able to:

1. Recognize heat as a form of energy.
2. Identify/list objects that produce heat.
3. State ways in which heat is used in everyday activities.
4. Appreciate the role of human-made devices that provide heat.
5. Infer that heat is sometimes produced as wasted energy.

PROCESS SKILLS

Observing, Communicating and Predicting

MATERIALS

Extension cord with light bulb , etc. , work sheets.

CONTENT SUMMARY

- Heat is a form of energy.
- Heat is useful in many different ways:
 - To cook our food
 - To melt things
 - To make our clothes smooth
 - To keep us warm
 - To dry things.
- Some natural objects, materials and living things produce heat. Fuels when lit, and the sun produce heat. Our bodies produce heat.
- People have invented many devices to conveniently and safely provide heat in the home and around us (stoves, ovens, irons, coal pots).
- Sometimes heat produced is wasted, for example, some devices and appliances such as light bulbs produce heat when they work and this heat is not put to any useful purpose.
- People invent devices to solve problems.

SUGGESTED ACTIVITIES

1. Ask students to make a list of all the things they can think of that produce heat. They distinguish between those that are natural and those that are made by people.
2. They review fuels and the Sun as sources of heat. Students discuss their own body temperature – e.g. Is it usually warm? Is it warmer than the room temperature? If possible they take their body temperature and compare it with the temperature of the room. They discuss whether the body temperature of people changes in cold climates. They conclude that their bodies produce heat.
3. They discuss the devices made by humans to make it easier for us to get heat in our homes. This can be done on a prepared worksheet with two columns.

Human-made devices/appliances that produce heat	What it is used for

Let students share information on the worksheets and use this information to stimulate discussion on the usefulness of these devices.

4. Let students discuss those instances where heat produced by devices and appliances is not actually used but is wasted instead. Let students discuss examples, such as fans, transformers, light bulbs. Students say what the devices are actually used for. Let students touch these devices before and after a demonstration of their use. Discuss the observed temperature difference and infer that heat produced in these cases is wasted.
5. Divide class into groups and give to each group a picture of a heating device: sun, stove, iron, etc. Let them think of, and write down how different their lives would be without that particular thing. Students investigate how these devices work, how they make it convenient and safe for humans to use the sources of heat. Let them share the ideas with the whole class.
6. Different groups of students can do research to find out the inventors and invention dates of the heating devices identified. They share their information and draw a time line.

ASSESSMENT

Students are asked to complete the table by placing a tick (v) in the appropriate cell

Device (use pictures)	Produces useful heat	Produces wasted heat	Produces no heat
Light bulb in bedroom			
Electric iron			
Transformer			
Gas oven			
Coal pot			
Refrigerators			
Curling iron			

DURATION: 1 Lesson

OBJECTIVES

Students should be able to:

1. Recognize that light is a form of energy.
2. List objects that emit light.
3. State ways in which light is used in everyday activities.
4. Appreciate the role of human-made devices that provide light in our everyday lives.

PROCESS SKILLS

Observing

MATERIALS

Camera (with a flash), a room that can be made very dark, objects that produce/emit light, pictures of persons engaged in activities during the night using artificial light: working, playing soccer/cricket, etc., reading/studying.

CONTENT SUMMARY

- Light is a form of energy
- We need light in order to see things
- Some devices such as calculators use light energy to work
- Many objects, both natural and human-made, produce/ emit light
- Artificial light has made it possible for us to work and play in the night or in otherwise dark places.

SUGGESTED ACTIVITIES

1. Take students (in group) into the dark room for a short while and ask them to note any three things they see in the room. Once all students have done this let them share with the rest of the class what they saw. Repeat the activity, this time with the lights on in the room. Now engage students in a discussion aimed at establishing the usefulness of light.
2. Display pictures and let students describe the activity taking place in each picture. Engage them in a discussion aimed at establishing the importance of light to these activities. Questions such as these may be used:

- What is happening in this picture?
 - At what time of day is it taking place?
 - How is it possible for this to happen in the night?
 - If the lights were to go out what will happen?
3. Ask students to list the things in their environment that give off light.

ASSESSMENT

- Students do an assignment to:
 - (i) find out the inventors of (a) incandescent and (b) fluorescent lights.
 - (ii) compare an electric lamp and a candle as sources of light to do their homework.

DURATION: 2 Lessons

OBJECTIVES

Students should be able to:

1. State ways in which solar energy is used in the home.
2. Appreciate the role of the sun as the main provider of heat and light in the world.

PROCESS SKILLS

Observing, Inferring, Measuring

MATERIALS

Water, metal containers, solar powered calculators, pictures of solar water heaters, clocks/stop watches, thermometer, black electrical tape.

CONTENT SUMMARY

- Energy from the sun is called solar energy. This comes to us in two main forms: heat and light.
- The sun's heat evaporates water and therefore is useful in drying things.
- The sun's heat can be trapped by solar panels in solar water heaters.
- The sun's light can be used to power calculators and other similar devices.
- Plants use the light of the sun to make food. We get some of this energy when we eat plant products.
- Without the sun the world would be a very cold dark place and plants and animals could not survive.

SUGGESTED ACTIVITIES

Organize class into working groups for these activities.

1. Let each group place (approximately) the same amount of water in two metal cans. Record the temperature of the water. Place one can on a table where it is exposed to direct sunlight and place the other on a table in the classroom. Let students measure and record the temperature of the water at intervals. Let students make simple time/temperature graphs. Let them study the graphs and then make a prediction as to what the temperature would be by a particular time.

2. Let students spill some water on the concrete in two places: one in a shaded area and the other in an area exposed to direct sunlight to determine how quickly they evaporate. Let them make predictions as to what would happen. (*Cross link with the water cycle*).
3. Distribute a solar powered calculator to each group and let students perform some basic mathematical operations. Let them place a strip of black electrical tape over the solar cells, then try to repeat the operations. (It should not work). Let them remove the tape and then try to do the operations again.
4. Let students focus on plant foods that we eat to get energy. Discuss where plants get their food. (*Cross link with food chains*)
5. Engage students in a whole-class discussion focusing on the findings of each of the activities done.

ASSESSMENT

- Let students write a paragraph or poem on what life/ the world would be like if the sun were to stop shining. Let students draw a concept web on the importance of the sun.

UNIT: ENERGY (GRADE 4)

DURATION: 1 Lesson

OBJECTIVES

Students should be able to:

1. Explain how a thermometer works.

PROCESS SKILLS

Observing, Designing

MATERIALS

Small clear bottles (heat resistant), drinking straws, Styrofoam plates (the sort in which meats/burgers are packaged), play dough/plasticine, tape, water, red dye, alcohol thermometers, ice cubes, heat source (spirit burner, candle, Bunsen burner)

CONTENT SUMMARY

- How hot or cold something is known as temperature. A thermometer is used to measure temperature.
- There are different kinds of thermometers. The most common is one which contains a liquid in a glass tube.
- The glass tube has a bulb which contains most of the liquid and a narrow hole which runs through the length of the tube. The two most common liquids used are mercury and alcohol.
- As temperature increases, the liquid in the bulb expands and moves further up the tube.
- The glass tube has markings and numbers on it, similar to those on a ruler. These markings and numbers, however, represent degrees, the unit in which temperature is measured.

SUGGESTED ACTIVITIES

1. Divide class into groups and distribute a thermometer (alcohol) to each group. Instruct students to be very careful in handling the thermometer since it can break easily. Let students do the following: (1) record all the features they observe (2) make a drawing of the thermometer.

When these two activities have been completed, lead a whole class discussion aimed at establishing the features of a thermometer.

2. Distribute a container containing some warm water (about 50°C) and one containing some water and ice to each group. Let students place the bulb of the thermometer in each of the containers. Use questions to stimulate class discussion on what happened to the alcohol when the thermometer was placed in the warm water? Why did that happen? How would you explain what happened? Do you think the same thing would happen if it was water in the thermometer instead of alcohol? etc. Tell students that alcohol used in thermometers is colourless, but a red dye is added to the alcohol in thermometers. Ask students if they could suggest why.

ASSESSMENT

Quiz on reasons for movement of alcohol level in the thermometer.

DURATION: 2 Lessons

OBJECTIVES

Students should be able to:

1. Use a thermometer to measure temperature.
2. Use an appropriate form to display results of experiments.
3. List situations where the use of a thermometer is important.

PROCESS SKILLS

Measurement, Recording

MATERIALS

Thermometers (preferably alcohol), worksheets

CONTENT SUMMARY

- The thermometer is used to measure temperature.
- The bulb of the thermometer must be placed in the substance/ material whose temperature is being measured.
- Thermometers are used to measure body temperature, atmospheric temperature, temperature of meats that are being cooked or stored, etc.

SUGGESTED ACTIVITIES

1. Divide class into working groups and let each group conduct the following investigations:
 - (a) To measure and record the atmospheric temperature over a five-day period.
 - (b) To measure the atmospheric temperature at different times during a particular day.

Each group should be provided with a thermometer and a worksheet for each of the activities and should be given specific instructions as to how the investigation should be conducted.

For investigation (a) the temperature reading must be taken at the same place and same time each day.

For investigation (b) the temperature reading should be taken at the same place.

WORKSHEET A

DAY	TEMPERATURE	WEATHER CONDITIONS

WORKSHEET B

TIME	TEMPERATURE
9:00 AM	
11:00 AM	
1:00 AM	
3:00 AM	

Engage students in a whole class discussion around the results of the worksheets: -

- Why was it necessary to record the temperature at the same place and time of day in Activity A?
- Why was it important to take the reading at the same place in activity B?
- Why were the readings the same/different in Activity A?
- Why did the temperature change/not change in Activity B?

Describe situations where it is important to record/know temperature.

2. Let students display the information collected in an appropriate form: Bar Chart, Line Graph.

ASSESSMENT

- Grade students' presentations of bar charts and line graphs

DURATION: 4 Lessons

OBJECTIVES

Students should be able to:

1. Investigate the effect of light on materials.

PROCESS SKILLS

Observing, Communicating, Experimenting

MATERIALS

A piece of brightly coloured (uniform) material, pair of scissors, corn seeds/pigeon pea seeds, cotton wool, petri dishes/wide-mouth jar covers, water, shoe box with cover.

CONTENT SUMMARY

- Both living and non-living materials can be affected by light.
- Exposure to strong light can cause some colours to fade.
- Light is needed by plants to produce chlorophyll and light energy and chlorophyll are needed by plants to make food.
- Some reading glasses are photosensitive/light sensitive. They become darker as the light gets stronger.

SUGGESTED ACTIVITIES

Inform students that they would be conducting a set of investigations aimed at observing the effects of light on materials and that some of these investigations would be done over an extended period of time (2 weeks).

1. Cut several 4-inch squares from a piece of brightly coloured material. Give each working group a piece of the material and let them place it in a selected area exposed to direct sunlight. Keep the rest of the material in a cupboard for later comparison. Each group should place their material in the sun daily for a period of about 2 weeks. Comparisons should be made with the piece retained and kept away from light, at selected intervals: after 2 days, after 4 days etc., and then at the end of the period.

Discuss the observed differences:

- How was the material placed in the sun different from the piece from which it was taken?
 - What was responsible for the change?
2. Distribute the following to each of the working groups: - two pots (containers) with identical seedlings.

These instructions should be followed:

- place one container in a dark cupboard;
 - place the other container in an area exposed to bright light;
 - compare seedlings at the end of one week, and then two weeks.
3. Use a pair of photo-sensitive reading glasses to demonstrate how it is affected by light intensity. Let students observe the colour of the glass within the classroom, and then outside in strong sunlight.

ASSESSMENT

1. HOME SURVEY

Let students conduct a survey in the home to identify places/materials that have been affected by exposure to light (faded curtains, furniture, paint on walls).

Students should also identify situations where people use the bleaching action of the sun.

Reports should be presented to class.

DURATION: 2 Lessons

OBJECTIVES

Students should be able to:

1. Investigate the effect of heat on materials.
2. State some effects of heat on materials.
3. Infer that the sun's heat helps to produce wind.

PROCESS SKILLS

Observing, Inferring

MATERIALS

Water, candle wax, plastic, nails, coin, a beaker, saw dust, heat source, alcohol, test tube.

CONTENT SUMMARY

Heat affects materials in the following ways: -

- It causes liquids like water to boil.
- It causes liquids like water to evaporate.
- It causes some materials to melt.
- It causes some materials to expand.
- It causes some materials to ignite and burn.

SUGGESTED ACTIVITIES

1. Place 50 ml-100ml water in a metal container or beaker and ask students to observe the water at the room temperature.
Heat water until it begins to boil. During the time of heating let students observe the water and note any changes.
2. Pour about 10ml alcohol into a test tube. Turn heat source off and place the test tube containing the alcohol into the hot water bath. **(SAFETY – ALCOHOL SHOULD NOT BE USED WITH A NAKED FLAME!)**
Give students the opportunity to explain their observations.
3. Place some candle wax in metal container and ask students to say what would happen when the container is placed over the heat source.
Heat container and let students observe what happens.
Ask students to list other materials that would melt upon heating.

4. The expansion principle may also be demonstrated using two nails inserted into a piece of wood and a coin.
 - Place nails firmly into the piece of wood with a distance that would just permit the coin to pass between them
 - Heat coin then try to pass it through
 - The nails may also be heated instead of the coin.
5. Demonstrate the burning of materials such as paper, splints, magnesium ribbon. (Be sure to observe safety procedures and warn students of the dangers of children playing with fire.)
6. Mix some saw dust with water in a temperature beaker and heat the beaker at one end to set up convection current. Let students describe what they observe. Explain that air in the atmosphere behaves in a similar way to water in this respect. That is, when one part is heated more than the other it begins to move in a particular direction. (This should help students to better understand and appreciate how land and sea breezes are caused: - a concept covered in “Earth’s Weather – objective 8”

ASSESSMENT

- Oral question-and-answer session:

Possible questions

1. What happens to water when it is heated
2. Give some examples of other substances which would be affected in a similar way.
3. In what other ways does heat affect substances?
4. Give some examples of substances that will burn or melt or expand when heated.

DURATION: 1 Lesson

OBJECTIVES

Students should be able to:

1. List examples of fuels used in the home, for transportation and for industrial production.
2. Discuss some of the consequences of using these fuels.
3. Suggest ways of reducing and controlling undesirable consequences of the use of fuels.

PROCESS SKILLS

Communicating, Researching

MATERIALS

Sample of charcoal, wood, gasoline, diesel, kerosene, picture of liquid petroleum gas LPG cylinders, pictures of equipment that use various types of fuels. Pictures of factories/generating plants emitting smoke.

CONTENT SUMMARY

- A fuel is any substance/material that is burned to produce energy.
- Several kinds of fuels are used in our homes and communities to generate energy.
- LPG is used in some cookers to produce heat for cooking and baking.
- Kerosene is used in some stoves to produce heat for cooking.
- Gasoline and diesel are used by motor vehicles to provide the energy they need to travel.
- Diesel is used in generators to produce electricity.
- Charcoal and wood are used in some homes to provide heat for cooking and baking.
- The uses of these fuels have some negative effect on the environment. e.g. pollution of the air, oil spills on the oceans, cutting down of trees etc.
- *(Optional) The green-house effect is one of the ill-effects of the use of these fuels. Acid rain is another.*
- *Explain the green-house effect in simple terms (Note: Just an awareness is required).*
- Heavy air pollution causes respiratory problems.
- Reducing our use of these fuels can help to reduce the ill effects.

SUGGESTED ACTIVITIES

- Display pictures of various pieces of equipment that use the different fuels. Let students identify each and state their various uses.
- Next, let students specify the source of energy (what fuel is used) in each case.
- Display pictures of smoking industrial plants and vehicles and use them as stimulus material for a discussion on the ill effects (pollution) caused by the use of these fuels.
- Lead discussion on ways in which we can reduce our dependence on these fuels.

ASSESSMENT & FOLLOW – UP

1. A written exercise :

Use the words in the list to complete the table below:
Gasolene, coals, diesel, LPG (gas), kerosene

Equipment	Fuel Used
Gas cooker	
Bus	
Coal pot	
Car	
Factory(emitting smoke)	
Aeroplane	
Bulldozer	
Motorbicycle	
Candle	
Kerosene lamp	

2. Which of these problems are caused by the use of fuels such as coal, wood and gasolene?
 - A. floods
 - B. acid rain
 - C. the greenhouse effect
 - D. water shortage/drought
 - E. respiratory diseases

- 3. (Optional) Let students do some research on the green-house effect and acid rain. What are they? How do they affect us? What causes them? What can we do about them? Students make oral presentations.*

DURATION: 1 Lesson

OBJECTIVES

Students should be able to:

1. Trace the flow of energy through a food chain.
2. Infer that the sun provides the energy needed by all living organisms.

PROCESS SKILLS

Communicating, Inferring

MATERIALS

Pictures of various animals and humans feeding. A video clip can be used alternatively.

CONTENT SUMMARY

- All living things need energy to carry out their activities. This energy is obtained from the food they make(plants) or eat (animals).
- Plants use light energy from the sun to make the substances they need to grow and carry out the activities. The process by which this is done is photosynthesis.
- Some animals eat plant materials to obtain the substances they need to grow and carry out their activities. These animals are called herbivores.
- Some animals feed on the flesh or products of other animals from which they obtain the substances they need to grow and carry out their activities. These animals are called carnivores.
- The sun is the source of all energy available to living organisms.

SUGGESTED ACTIVITIES

1. Display picture chart/show video clip of animals feeding and use this to stimulate class discussion. Guiding questions:

What are these animals doing?
Why do they need to feed/eat?
What do they get from the food?

Why do we need energy?

2. Ask students to list the things they had for lunch/breakfast/(or which they normally eat). Make list on board. Challenge students to determine the origin of bread, meat, etc. (The idea here is to show that plants are the source).

ASSESSMENT

- Let students construct flow charts (food chains) consisting of at least three stages to show how food passes from one organism to another, beginning with plants. They can either write the words or draw diagrams.

DURATION: 1 Lesson

OBJECTIVES

Students should be able to:

1. List other forms of energy apart from heat and light.
2. Infer that energy can be changed from one form to another.
3. Give simple examples of energy transformation.
4. List devices/appliances that are energy changers.

PROCESS SKILLS

Inferring, Observing

MATERIALS

Pictures depicting various forms of energy, a lighted bulb, electrical iron, radio (battery operated), electrical fan, flashlight, spring, rubber band, food samples

CONTENT SUMMARY

- There are other forms of energy apart from heat and light. These include energy stored in foods and batteries (chemical energy); the energy moving objects possess (kinetic energy); the energy contained in a stretched spring or piece of rubber (potential energy); sound energy and electrical energy.
- Energy can be changed from one form to another. For example, chemical energy in a dry cell (battery) can be changed to electrical energy, which is then changed to heat and/or light energy.
- Chemical \longrightarrow Electrical \longrightarrow Heat + Light

SUGGESTED ACTIVITIES:

(This must be kept very simple. Students may not know the terms for the form of energy e.g. chemical. They can use “energy in batteries” to “light “ for example.)

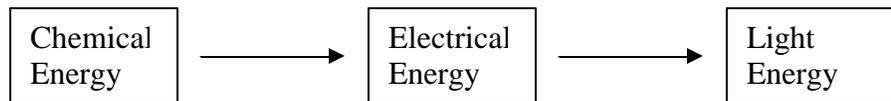
1. Display a few devices, which produce heat and light energy and ask students to state what form of energy each produces. Ask if anyone knows of any other form of energy apart from heat and light. List them and complete list. Solicit and offer simple explanation of each type using pictures or actual objects as reinforcement.

2. Display a number of devices (radio, flashlight, fan, etc.) and challenge students to figure out how each of the devices is able to produce the form of energy it does.

For example: - How is a flashlight able to produce light?

- : - How is radio able to produce sound?
- : - How is an electrical iron able to produce heat?
- : - How are our bodies able to produce heat?
- : - How is the fan able to produce motion (kinetic energy):

Record students' explanations in the form of flow charts: -
e.g. flash light

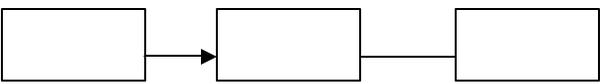
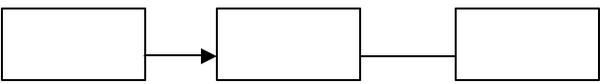
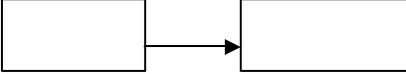
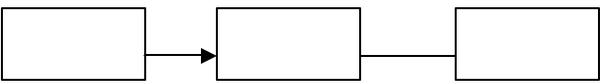


Once this is done ask students to write down a concluding statement about energy, based on what was observed. (Energy can be changed from one form to another).

ASSESSMENT

- Display pictures and ask students to either explain orally or draw flow charts to depict the energy transformation.
- Alternatively, students could be presented with a work sheet on which the transformation is to be written.

WORK SHEET

<p>EQUIPMENT/OBJECT (Use pictures instead)</p>	<p>ENERGY CHANGES</p>
<p>Flashlight showing light</p> 	
<p>Radio</p> 	
<p>Coal pot with burning coals</p> 	
<p>A moving vehicle</p> 	

 <p>An athlete on the run</p>	
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1. Challenge students to design and make a simple device that is able to change energy from one form to another (sling shot, cotton reel carts, etc.)

DURATION: 2 Lesson

OBJECTIVES

Students should be able to:

1. Investigate how specific forms of technology have changed over time.
2. Draw a time line/flow chart to show how a specific form of technology has changed over time.
3. Suggest reasons for the improvements observed.

PROCESS SKILLS

Communicating

MATERIALS

Pictures of radio, refrigerator or motor car.

CONTENT SUMMARY

- Human beings are constantly seeking ways of improving technological devices to make them more efficient.

SUGGESTED ACTIVITIES

1. Divide students into working groups and give to each group one form of technology (motor vehicle, televisions, irons, cookers, radios, etc.). Instruct groups to conduct research into the development of each form.
Guiding Questions: -
 - When was it first invented?
 - Who invented it?
 - What did the earlier ones look like?
 - How different are they today?
 - What are some advantages of newer models over the older? What are some disadvantages of the new models?
 - Projects could be presented in the form of a time chart of pictures.

ASSESSMENT

1. Students could be graded for their group effort, the time chart and their presentation.

Criteria:

Amount of information	10 points
Presentation/Arrangement/Organization	10 points
Effort	5 points

DURATION: 1 Lesson

OBJECTIVES

Students should be able to:

1. Develop a set of questions that can be used to compare devices used to provide heat or light.
2. State at least one advantage and one disadvantage of each of the devices.

PROCESS SKILLS

Observing, Recording, Reporting

MATERIALS

Coal pot, iron/electrical iron, filament bulb/fluorescent bulb, small pocket light/large flashlight, etc.

CONTENT SUMMARY

- Some forms of technology are easier and/or better to use than others made for the same purpose.
- There are advantages and disadvantages in using technology, for example:
 - Some use more energy than others and are therefore more expensive to operate.
 - Some pollute the atmosphere more than others.

SUGGESTED ACTIVITIES

1. Organize working groups and give to each group a pair of devices (performing similar function) and ask students to determine how well they do what they are made to do. Ask students to write down the questions they will ask someone in order to determine which technology is better.
2. Ask students to list at least one advantage/disadvantage of one technology over the other.

ASSESSMENT

1. Students' work from the activities should be used for assessing performance.

Module 3

Energy

Grade 5

GENERAL OBJECTIVES

The students should be able to:

1. Understand that electrical energy is transferred in circuits.
2. Use the design process to create a product.

SPECIFIC OBJECTIVES

The students should be able to:

1. Name the parts of a simple electrical circuit.
2. Set up simple electrical circuits.
3. Distinguish between conductors of electricity and insulators.
4. Explain how conductors and insulators are used.
5. Design and make devices that demonstrate energy transformations (e.g. electricity to light; electricity to sound).
6. Practise safety measures in using electrical devices.

LEVELS OF ATTITUDES, SKILLS & TECHNOLOGY EXPECTED AT GRADES 5 - 6

ATTITUDES:

Students should be encouraged to:

Curiosity:	<ul style="list-style-type: none"> ✓ Ask questions about objects and events. ✓ Find out more about events and objects on their own.
Inventiveness:	<ul style="list-style-type: none"> ✓ Suggest new ways of doing things. ✓ Use equipment in novel ways.
Respect For Evidence	<ul style="list-style-type: none"> ✓ Use evidence to justify their conclusions. ✓ Listen to other students' results and explanations. ✓ Recognize when conclusions do not fit the evidence. ✓ Change their ideas in response to evidence. ✓ Point out contradictions in reports by their classmates. ✓ Show a willingness to review procedures and evaluate their work.
Persistence	<ul style="list-style-type: none"> ✓ Complete activities. ✓ Persist at tasks. ✓ Repeat experiments when previous attempts have failed.
Respect For Living Things	<ul style="list-style-type: none"> ✓ Show sensitivity to living things.
Cooperation	<ul style="list-style-type: none"> ✓ Share with others. ✓ Work together with others. ✓ Accept responsibilities.
Concern For Safety	<ul style="list-style-type: none"> ✓ Observe safety instructions.

SKILLS

SKILLS:	
In developing their skills of inquiry, problem solving and design the students are expected to:	
Observing	<ul style="list-style-type: none"> ✓ Use as many senses as are appropriate and safe to gather information. ✓ Identify differences and similarities between objects and events. ✓ Identify sequence in events. ✓ Distinguish from many observations those that are relevant to an investigation.
Measuring	<ul style="list-style-type: none"> ✓ Use simple measuring instruments or models of measuring instruments. ✓ Use units in measurement.
Manipulating	<ul style="list-style-type: none"> ✓ Set up simple experiments to compare results. ✓ Manipulate simple equipment.
Recording	<ul style="list-style-type: none"> ✓ Use pictures and charts to report results. ✓ Fill out simple tables to report results.
Classifying	<ul style="list-style-type: none"> ✓ Group objects according to several criteria.
Communicating	<ul style="list-style-type: none"> ✓ Talk freely about their activities and the ideas they have, with or without making a written record. ✓ Use appropriate vocabulary to describe their observations. ✓ Listen to others' ideas and look at their results. ✓ Write reports on their investigations. ✓ Use bar graphs, pictures, tables and charts to report results. ✓ Regularly and spontaneously use books and other sources to check or supplement investigations. ✓ Select appropriate methods to report events. Include drawings, reports and multi media.

SKILLS CONT'D

Inferring	<ul style="list-style-type: none"> ✓ Notice patterns in data. ✓ Draw reasonable conclusions from data.
Interpreting data	<ul style="list-style-type: none"> ✓ Discuss what they find out in response to questions. ✓ Compare their findings with their predictions. ✓ Make associations with change in variables and results.
Experimenting	<ul style="list-style-type: none"> ✓ Freely ask a variety of questions and suggest how they might be answered. ✓ Formulate problems to be investigated. ✓ Suggest how they could investigate to find out answers to questions. ✓ Plan to conduct investigations. Select equipment, materials and procedures for conducting investigations. ✓ Understand what is a fair test. ✓ Keep appropriate variables constant and vary the independent variable in experiments.
Predicting	<ul style="list-style-type: none"> ✓ Use evidence in making predictions. ✓ Show how they have used evidence in making predictions.
Hypothesizing	<ul style="list-style-type: none"> ✓ Attempt to explain things that are consistent with evidence. ✓ Suggest how something may have happened.
Problem Solving	<ul style="list-style-type: none"> ✓ Suggest solutions to simple problems. ✓ Identify needs, formulate questions, conduct research and design solutions to problems.
Designing	<ul style="list-style-type: none"> ✓ Construct models either by following instructions or by using their own designs. ✓ Select appropriate material to make models and gadgets. ✓ Formulate problems, do appropriate research, and devise solutions. ✓ Select appropriate material to make models and gadgets. ✓ Evaluate their own designs and the designs of others using simple criteria.

TECHNOLOGY

<p>Technological Methods</p>	<ul style="list-style-type: none"> ✓ Students will be able to formulate problems, do appropriate research and devise solutions (e.g. construct gadgets).
<p>Nature Of Technology</p>	<ul style="list-style-type: none"> ✓ Look at past inventions in their historical context. ✓ Understand that products are replicable. ✓ Understand that others may be working on the same idea. ✓ Realise that <i>they can use scientific knowledge in doing technology</i> and that technology helps to develop reliable scientific information. ✓ Understand the importance of precision and safety in developing new products. ✓ Understand that technology is novel and creative. ✓ Understand that if the people in a country are creative and innovative, their country can progress. ✓ Understand that people use processes involving living things (Biotechnology) and materials (Production Technology) to satisfy their needs.
<p><u>Use Of Technology</u></p>	<ul style="list-style-type: none"> ✓ Appreciate the use of devices, tools and structures made by humans in the home and community. ✓ Appreciate the advantages of using these products. ✓ Realize that human-made things can pollute the environment. ✓ Look at advantages and disadvantages to help them make decisions of what is the best technology that can be used in a particular situation. ✓ Realize that people may abuse and misuse technology. ✓ Understand that technology may have unintended consequences.

Unit: energy (grade 5)

DURATION: 1 Lesson

OBJECTIVES

Students should be able to:

1. Set up simple electrical circuits.
2. Name the parts of a simple electrical circuit.
3. Explain the functions of each of the components in the circuit.

PROCESS SKILLS

Observing, Manipulating, Communicating, Problem solving

MATERIALS

Dry cells, connecting wires, bulbs, tape

CONTENT SUMMARY

- The path taken by an electric current is called a circuit. In a circuit there must be a source of electricity, connecting wires, and an electrical appliance that can use the current.
 - A dry cell (what we commonly call a battery) is a source of electricity. It contains chemical energy which it changes to electrical energy.
 - The connecting wires provide a path through which the current passes.
 - A bulb changes the electrical energy to light and heat energy.
 - The current will flow only when all these part are correctly connected (the circuit is closed).

SUGGESTED ACTIVITIES

1. Divide students into groups and present each group with a bulb. Ask students to identify what it is and state its use. Then, ask them to demonstrate its use (make it show light). It is expected that students will express the need for other things to make the bulb light.
2. Ask students to determine what is needed and collect them from a designated supplies area.

3. Once they are successful in lighting the bulb let students make a schematic diagram of their set-up. Explain then that what they have just made and drawn is called an electrical circuit. Review the parts of the circuit and let students explain the role of each component within the circuit.
4. Ask for suggestions as to other components that can be introduced into the circuit. Try these things in a subsequent lesson.

ASSESSMENT

- Use review questions to ascertain that students can name parts of a circuit and state the function of each part.

DURATION: 1 Lesson

OBJECTIVES

Students should be able to:

1. Describe the energy transformations that take place in specific electrical circuits.
2. Name appliances in the home that transform electrical energy to other forms of energy, and explain these transformations/changes.
3. Design and make a device that demonstrates energy transformations.

PROCESS SKILLS

Observing, Manipulating, Communicating, Problem-solving, Drawing

MATERIALS

Dry cells, connecting wires, bulbs, tape, small electrical motors

CONTENT SUMMARY

- Electrical energy can be changed to other forms of energy: heat, light, sound.
- Many different devices in our homes and around us are able to change electrical energy to other forms of energy. For example, a light bulb changes electrical energy to heat and light; a television changes electrical energy to light, sound and heat; an electrical iron changes electrical energy to heat; an electrical fan changes electrical energy to movement (kinetic) energy, sound and heat.

SUGGESTED ACTIVITIES

1. Let students examine a bulb and point out the various parts. Let them offer explanations as to the use of each part. Pay particular attention to the filament inside. Let them draw a simple diagram of the bulb.
2. Let students construct a simple circuit using connecting wires, a dry cell, and a bulb. Let them try to explain what happens within the circuit to produce light. Pay particular attention to the filament. Establish that the bulb changes the electrical energy to light. As the current (the electrical energy) travels through the filament, it causes it to glow. This is how the light is produced. Ask for other devices which convert electrical energy to light.
3. Repeat the procedure with a slight adjustment. This time let students touch the bulb prior to and after the activity and note any differences

in temperature. Establish that some of the electrical energy is also changed to heat. Let them give examples of other devices which change electrical energy to heat

4. Replace the bulb in the circuit with a small electrical motor. Allow students to explain the transformation in this case (movement- Kinetic energy and sound energy). Let them give examples of other common devices which change electrical energy to movement, or sound.

ASSESSMENT

- Present a worksheet with a list of common electrical appliances and let students complete it by filling in the transformation that takes place, e.g.

APPLIANCE	WHAT IT CHANGES ELECTRICAL ENERGY TO
Iron	
Radio	
Television	

FOLLOW-UP PROJECT ACTIVITY

Challenge students to design and make

- (a) a useful device/structure that incorporates a circuit that changes electrical energy to light (e.g. a lamp or torchlight) or
- (b) a device that changes electrical energy to another form of energy (e.g. a simple electrical bell or an electromagnet).

DURATION: 2 Lessons

OBJECTIVES

Students should be able to:

1. Distinguish between conductors of electricity and insulators.
2. Explain how insulators can be useful.

PROCESS SKILLS

Observing, Manipulating, and Communicating.

MATERIALS

A pre-constructed circuit with bulbs, cells connecting wires and a testing gap; bits of materials such as insulated wire, paper, strips of aluminium foil, iron nails, strips of plastic, strips of rubber, match sticks, etc: a pair of scissors, pliers, work sheets.

CONTENT SUMMARY

- Some materials allow electrical current to pass through easily while others do not. Materials which allow electrical current to travel through them easily are called conductors. Those which do not are called non-conductors or insulators.
- Metals are good conductors of electricity. Copper is a common metal used to make electrical wires.
- Insulators are important to prevent electric shock. They are used to cover materials through which electricity passes. Common insulators include plastic and rubber.

SUGGESTED ACTIVITIES

1. Let students examine and account for the structure of a piece of insulated electrical wire. This could be done as a group activity.

Ask: What is it made of?
 What is the use of the metal wire inside?
 What is the use of the plastic around the metal wire?

2. Let students (in groups) use the circuit with a testing gap to test for conductivity of the outer covering of the piece of insulated wire, and then piece of the inner wire. Repeat this procedure using the other bits of materials in the collection. Let students complete a table on a prepared work sheet.

Material	Did the bulb light? (Yes/No)	Conductor	Insulator
Plastic			
A metal paper clip			
A nail			
Paper			
A metal coin			

3. Discuss the results of the activity and establish the importance of the rubber or plastic covering on electrical wires.
4. As homework activity, let students find out about the kind of material such things as plugs, switches, electric iron handles, etc. are made of, and why.

ASSESSMENT

➤ Use a matching pairs game to conduct a quiz based on the information covered in lesson. Pairs of pictures should be all related to the lesson (bulbs, appliances, etc.)

1. Hang pairs of pictures face down on a card-board sheet.
2. Hang the game on the chalk board.
3. Divide the class into teams.

4. Pose a question on the lesson content to one of the teams. If they answer correctly the team gets a chance to turn up two cards on the board in an effort to find a matching pair.
5. Award ten points for each matching pair uncovered.
6. Give bonus points (2) if the team is able to state one fact about the first card it uncovers.



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Type of Diagram

DURATION: 1 Lesson

OBJECTIVES

Students should be able to:

1. State the dangers posed by electricity.
2. Explain safety measures that should be observed in order to prevent these dangers.

PROCESS SKILLS

Observing, Manipulating, Communicating, Inferring

MATERIALS

Circuit board or a complete circuit with cells connecting wires, additional cells and low voltage bulbs.

CONTENT SUMMARY

- Electrical energy (electrical current) can be dangerous. Faulty or overloaded circuits can result in fires. Improper handling can result in electrical shock which can kill the individual or result in serious burns and disfigurement. It can also damage electrical appliances.

SUGGESTED ACTIVITIES

1. As a group activity let students complete a circuit with one cell to light the bulb. Let them increase the number of cells progressively by one until the bulb burns out. Challenge students to offer an explanation for the result. At this point introduce the concept of the volt being one of the measures of electricity; and as voltage increases electricity becomes more dangerous. Establish the voltage of the cells used in the activity (this is usually written on the side of the cell), as well as the voltage of mains electricity used in our homes. Question students as to the reason why some household appliances require transformers (to increase or decrease the voltage).

2. Facilitate a class discussion on the dangers of electricity, and the measures that should be taken to prevent electrical shock, fires and damage to appliances. A video presentation can be used as stimulus materials if such resources are available.

ASSESSMENT

Let students compile a list of **DO'S** and **DON'T'S** about the way we use electricity.

Examples: Do not touch an electric switch with wet hands.
Do not push anything except the plug of an appliance into an outlet.
Do not touch bare electric wires.
Dry wet hands before turning on an electric switch.

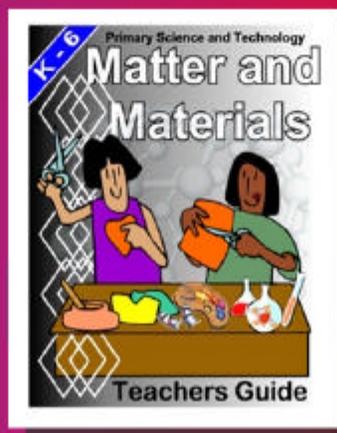
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